

AMENDMENTS TO THE CLAIMS

1. (Withdrawn) A method of processing fullerenes comprising:

generating a first gas stream comprising suspended soot particles, PAH, and condensable gases, said condensable gases comprising gaseous fullerenes,

reducing PAH content in said first gas stream,

separating, utilizing a filter, at least a portion of the suspended soot particles from ~~the condensable gases in~~ the first gas stream to obtain a second gas stream which comprises gaseous fullerenes and is reduced in soot content, and then

condensing at least a portion of the gaseous fullerenes in the second gas stream to collect condensed fullerenes,

wherein at least a portion of said gaseous fullerenes are not condensed prior to said separating.

2. (Withdrawn) The method of claim 1, wherein the first gas stream is obtained using ~~a method selected from the group consisting of combustion, arc plasma discharge, laser ablation, graphite burning, negative ion/desorption chemical ionization, and combinations thereof.~~

3-6. (Canceled).

7. (Withdrawn) The method of claim 1, wherein gaseous fullerenes having a volatility lower than a selected volatility are separated with the suspended soot particles during said separating.

8. (Withdrawn) The method of claim 1, wherein said reducing PAH content comprises providing the first gas stream ~~has~~ with a residence time of between about 10 msec and about 10 sec prior to said separating.

9. (Withdrawn) The method of claim 1, wherein said reducing PAH content comprises providing the first gas stream ~~has~~ with a residence time of between about 100 msec and about 2 sec prior to said separating.

10. (Withdrawn) The method of claim 1, wherein the condensable gases in said second gas stream is enhanced in selected fullerene species to a greater extent than other fullerene species.

11. (Withdrawn) The method of claim 1, wherein said separating comprises producing a first fraction and a second fraction of the second gas stream, and the concentration of the suspended soot particles in the first fraction is higher than the concentration of the suspended soot particles in the second fraction.

12. (Withdrawn) The method of claim 1, wherein said separating is accomplished at a temperature of less than about 1100 °C.

13. (Withdrawn) The method of claim 1, wherein said separating is accomplished at a temperature in the range of about 300 °C to about 2000 °C.

14. (Withdrawn) The method of claim 1, wherein said separating is accomplished at a temperature in the range of about 300 °C to about 900 °C.

15. (Canceled).

16. (Withdrawn) The method of claim 1, wherein the condensed fullerenes form as suspended fullerene particles.

17. (Withdrawn) The method of claim 16, wherein the condensed fullerenes condense by heterogeneous nucleation and/or homogeneous nucleation.

18. (Withdrawn) The method of claim 1, wherein said condensing comprises nucleation and/or growth of particles promoted by sonic, ionic, or radioactive methods.

19. (Withdrawn) The method of claim 17, wherein seed particles for said heterogeneous nucleation comprise soot.

20. (Withdrawn) The method of claim 1, further comprising:

collecting the condensed fullerenes.

21. (Withdrawn) The method of claim 20, wherein said collecting comprises separating the condensed fullerenes from the second gas stream.

22. (Withdrawn) The method of claim 21, wherein said separating the condensed fullerenes from the second gas stream are carried out using a process independently selected from the group consisting of filtration, electrostatic precipitation, electrostatic separation, inertial separation, and combinations thereof.

23. (Withdrawn) The method of claim 22, wherein said separating the condensed fullerenes from the second gas stream are carried out using a process independently selected from the group consisting of sieve filtration, fiber filtration, packed bed filtration, and combinations thereof.

24. (Withdrawn) The method of claim 20, wherein said collecting comprises condensing the gaseous fullerenes and/or the condensed fullerenes onto a surface.

25. (Withdrawn) The method of claim 16, wherein the mean size of the suspended fullerenes particles is in the range of 0.1 μm to 500 μm .

26. (Withdrawn) The method of claim 16, wherein the mean size of the suspended fullerenes particles is in the range of 10 μm to 200 μm .

27. (Withdrawn) The method of claim 20, wherein the velocity of the second gas stream is maintained at a velocity selected to minimize losses of fullerenes to surfaces during conveyance of the second gas stream to a collection site.

28. (Withdrawn) The method of claim 1, wherein a diluent gas is added to the first gas stream and/or the second gas stream.

29. (Withdrawn) The method of claim 1, wherein said condensing comprises condensing a first selected fullerene species or a first set of selected fullerene species.

30. (Withdrawn) The method of claim 29, further comprising:

collecting the condensed first selected fullerene species or the condensed first set of selected fullerene species.

31. (Withdrawn) The method of claim 30, wherein said collecting the condensed first selected fullerene species or the condensed first set of selected fullerene species comprises a gas/solid separations process.

32. (Withdrawn) The method of claim 31, further comprising:

condensing a second selected fullerene species or a second set of selected fullerene species after said condensing the first selected fullerene species or the first set of selected fullerene species.

33. (Withdrawn) The method of claim 32, further comprising:

collecting the condensed second selected fullerene species or the condensed second set of selected fullerene species.

34. (Withdrawn) The method of claim 33, wherein said collecting the condensed second selected fullerene species or the condensed second set of fullerene species comprises a second gas/solid separations process.

35. (Withdrawn) The method of claim 15, wherein the temperature of the second gas stream is in the range of about minus 250° C to 1200° C.

36. (Withdrawn) The method of claim 15, wherein the temperature of the second gas stream is in the range of about 100° C to 800° C.

37. (Withdrawn) The method of claim 1, further comprising:
maintaining conditions in a reaction zone subsequent to said separating to promote additional fullerene formation in the second gas stream.

38. (Withdrawn) The method of claim 37, wherein additional suspended soot particles are formed in the second gas stream as a by-product of the additional fullerene formation, said method further comprising separating at least a portion of the additional suspended soot particles from the second gas stream.

39. (Withdrawn) The method of claim 37, wherein temperatures in said reaction zone are maintained at about 500° C to 2200° C.

40. (Withdrawn) The method of claim 37, wherein temperatures in said reaction zone are maintained at about 900° C to 1700° C.

41. (Withdrawn) The method of claim 20, further comprising condensing and collecting non-fullerene condensable species subsequent to said collecting the condensed fullerenes.

42. (Withdrawn) The method of claim 41 wherein the non-fullerene condensable species comprises polycyclic aromatic hydrocarbons.

43. (Withdrawn) The method of claim 38, further comprising:

condensing at least a portion of the fullerenes from the condensable gases after said separating at least a portion of the additional suspended soot particles from the second gas stream; and

collecting the condensed fullerenes.

44. (Withdrawn) The method of claim 1 or 20, wherein said separating is operated in a steady mode.

45. (Withdrawn) The method of claim 1 or 20, wherein said separating is operated in an un-steady mode.

46. (Withdrawn) The method of claim 1, wherein the percentage by weight of fullerenes to soot and other condensables in the condensed fullerenes is in the range of about 70% to 100%.

47. (Withdrawn) The method of claim 20, wherein the collected condensed fullerenes are enriched in fullerenes as compared to the fullerene content of the first gas stream.

48. (Withdrawn) The method of claim 1, wherein the condensed fullerenes comprise about 10% to about 70% by weight fullerenes.

49. (Withdrawn) The method of claim 1, wherein temperature of the first gas stream and/or the second gas stream is controlled by conductively cooled surfaces, inert gases, heat absorption by phase change, or combinations thereof.

50. (Withdrawn) The method claim 1 or 20, wherein residence time of said separating is controlled by addition of an inert gas.

51. (Currently Amended) A method for processing fullerenes comprising:

burning a carbon-containing fuel in a combustion chamber under conditions effective to produce fullerenes and to generate a first gas stream comprising suspended soot particles, PAH, and condensable gases, said condensable gases comprising gaseous fullerenes;

reducing PAH content in said first gas stream;

separating, utilizing a filter located between the combustion chamber and a collection zone, at least a portion of the suspended soot particles from ~~the condensable gases in the first gas~~ stream to obtain a second gas stream which comprises gaseous fullerenes and is reduced in soot content;

condensing at least a portion of the gaseous fullerenes in the second gas stream; and

collecting the condensed fullerenes at the collection zone.

52. (Previously Presented) The method of claim 51, wherein said separating is accomplished at a temperature less than about 1100 °C.

53. (Previously Presented) The method of claim 51, wherein said separating is accomplished at a temperature in the range of about 300 °C to about 900 °C.

54-56. (Canceled).

57. (Currently Amended) The method of claim 51, wherein said reducing PAH content comprises providing the first gas stream ~~has with~~ a residence time of between about 10 msec and about 10 sec prior to said separating.

58. (Currently Amended) The method of claim 51, wherein said reducing PAH content comprises providing the first gas stream ~~has with~~ a residence time of between about 100 msec and about 2 sec prior to said separating.

59. (Previously Presented) The method of claim 51, wherein said separating comprises producing a first fraction and a second fraction of the second gas stream, and the concentration of the suspended soot particles in the first fraction is higher than the concentration of the suspended soot particles in the second fraction.

60. (Canceled).

61. (Previously Presented) The method of claim 51, wherein said separating is carried out using a process selected from the group consisting of sieve filtration, fiber filtration, packed bed filtration, and combinations thereof.

62. (Previously Presented) The method of claim 51, wherein said separating is accomplished utilizing a ceramic particulate filter.

63. (Original) The method of claim 62, wherein the ceramic particulate filter contains a catalyst to promote thermal regeneration of the filter to remove collected soot.

64. (Previously Presented) The method of claim 63, wherein the ceramic particulate filter is selected from the group consisting of cordierite, silicon carbide, alumina, alumina/silica compositions, and combinations thereof.

65. (Original) The method of claim 63, wherein the catalyst is a metal.

66. (Previously Presented) The method of claim 51, wherein said separating is conducted at a time and location selected to separate suspended soot particles that have an average particle size in the range of 0.1 μm – 100 μm .

67. (Previously Presented) The method of claim 51, wherein said separating is conducted at a time and location selected to separate suspended soot particles that are collectable on a filter having a mean effective pore size in the range of about 0.1 – 100 μm .

68. (Canceled).

69. (Previously Presented) The method of claim 51, wherein the condensed fullerenes condense as suspended fullerene particles.

70. (Previously Presented) The method of claim 69, wherein the condensed fullerenes condense by heterogeneous nucleation and/or homogeneous nucleation.

71. (Previously Presented) The method of claim 70, wherein seed particles for heterogeneous nucleation comprise soot.

72. (Canceled).

73. (Previously Presented) The method of claim 51, wherein the percentage by weight of fullerenes to soot and other condensables in the collected condensed fullerenes is in the range of about 70% to 100%.

74. (Previously Presented) The method of claim 51, wherein the collected condensed fullerenes is enriched in fullerenes as compared to the fullerene content of the first gas stream.

75. (Previously Presented) The method of claim 51, wherein the collected condensed fullerenes comprise about 10% to about 70% by weight fullerenes.

76. (Previously Presented) The method of claim 69, wherein the mean size of the suspended fullerene particles is in the range of 0.1 μm to 500 μm .

77. (Previously Presented) The method of claim 69, wherein the mean size of the suspended fullerene particles is in the range of 10 μm to 200 μm .

78. (Previously Presented) The method of claim 51, wherein said collecting the condensed fullerenes comprises separating the condensed fullerenes from the second gas stream.

79. (Previously Presented) The method of claim 78, wherein said separating the condensed fullerenes from the second gas stream is carried out using a process selected from the group consisting of filtration, electrostatic precipitation, inertial separation, electrostatic separation, and combinations thereof.

80. (Previously Presented) The method of claim 79, wherein said separating the condensed fullerenes from the second gas stream is carried out using a process selected from the group consisting of sieve filtration, fiber filtration, packed bed filtration, and combinations thereof.

81. (Previously Presented) The method of claim 51, wherein the second gas stream comprises nucleation sites to promote the condensation of the gaseous fullerenes.

82. (Original) The method of claim 81, wherein the nucleation sites comprise soot particles, or other suspended particles having a particle size in the range of about 0.01 μm – 100 μm .

83. (Previously Presented) The method of claim 51, further comprising:
condensing at least a portion of a non-fullerene species in the condensable gases after said separating; and
collecting the condensed non-fullerene species.

84. (Previously Presented) The method of claim 83, wherein said condensing at least a portion of a non-fullerene species is carried out at a temperature in the range of about negative 250 °C to about 600 °C.

85. (Previously Presented) The method of claim 51, wherein temperature of the first gas stream and/or second gas stream is controlled by conductively cooled surfaces, and/or inert gases, and/or heat absorption by phase change.

86. (Currently Amended) The method claim 51, wherein residence time of said ~~separating first gas stream~~ is altered by addition of an inert gas.

87. (Previously Presented) The method of claim 51, wherein the collected condensed fullerenes are substantially free of polycyclic aromatic hydrocarbons (PAH).

88. (Previously Presented) The method of claim 51, wherein the collected condensed fullerenes are substantially free of soot.

89. (Canceled).

90. (Previously presented) The method of claim 1 or 51, further comprising:
during or after said separating, introducing an oxidative species at temperatures that allow for oxidation of the separated soot.

91. (Currently Amended) A method for processing fullerenes, comprising:
burning a carbon-containing fuel in a flame in a combustion chamber under conditions effective to produce fullerenes and to generate a first gas stream comprising suspended soot particles, PAH, and condensable gases, said condensable gases comprising gaseous fullerenes;
separating, utilizing a filter located between the combustion chamber and a collection zone, at least a portion of the suspended soot particles from ~~the condensable gases in the first gas~~ stream to obtain a second gas stream, wherein the second gas stream comprises gaseous fullerenes and is reduced in soot content;

condensing at least a portion of the gaseous fullerenes in the second gas stream at a temperature between about 100 °C to about 800 °C to allow at least a portion of PAH in the second gas stream to remain as gaseous PAH in the second gas stream;

~~introducing the second gas stream into a subsequent location where further treatment or reaction of the gaseous fullerenes is conducted; and~~

collecting the condensed fullerenes at the collection zone.

92. (Previously Presented) The method of claim 91, wherein said condensing condenses at least a portion of the gaseous fullerenes in the second gas stream as suspended fullerene particles in the second gas stream, and the suspended fullerene particles are introduced into the subsequent location.

93-119. (Canceled).

120. (Withdrawn) A method of processing fullerenes comprising:

generating a first gas stream comprising suspended soot particles, PAH, and condensable gases, said condensable gases comprising gaseous fullerenes,

reducing PAH content in said first gas stream,

separating, utilizing a filter, at least a portion of the suspended soot particles from the first gas stream to obtain a second gas stream comprising said gaseous fullerene;

condensing at least a portion of the fullerenes in the second gas stream at a temperature between about 100 °C to about 800 °C to allow at least a portion of any non-fullerene species in the second gas stream to remain as gaseous non-fullerene species in the second gas stream; and

collecting the condensed fullerenes.

121. (Withdrawn) The method of claim 120, further comprising:

heating the collected fullerenes to sublime at least a fullerene species; and

condensing the sublimed fullerene species.

122. (Currently Amended) A method of processing fullerenes comprising:

generating a first gas stream comprising suspended soot particles, PAH, and condensable gases, said condensable gases comprising gaseous fullerenes,

reducing PAH content in said first gas stream,

separating, utilizing a filter, at least a portion of the suspended soot particles from ~~the condensable gases in~~ the first gas stream to obtain a second gas stream, wherein the second gas stream comprises gaseous fullerenes and is reduced in soot content;

condensing, after said separating, at least a portion of the gaseous fullerenes in the second gas stream; and

collecting the condensed fullerenes.

123. (Previously Presented): The method of claim 1, 51, 91, 120, or 122, wherein said condensing is carried out at a temperature in the range of about 100 °C to about 800 °C.

124. (New): The method of claim 91, further comprising condensing and collecting PAH subsequent to said collecting the condensed fullerenes.

125. (New) The method of claim 91, wherein said condensing at least a portion of the fullerenes in the second gas stream is carried out at a temperature between about 100 °C to about 550 °C.

126. (New) The method of claim 91, further comprising reducing PAH content in said first gas stream prior to said separating.